



# Full wwPDB X-ray Structure Validation Report ⓘ

Jun 12, 2024 – 07:51 AM EDT

PDB ID : 6NU1  
Title : Crystal Structure of Human PKM2 in Complex with L-cysteine  
Authors : Srivastava, D.; Nandi, S.; Dey, M.  
Deposited on : 2019-01-30  
Resolution : 2.25 Å(reported)

This is a Full wwPDB X-ray Structure Validation Report for a publicly released PDB entry.

We welcome your comments at [validation@mail.wwpdb.org](mailto:validation@mail.wwpdb.org)

A user guide is available at

<https://www.wwpdb.org/validation/2017/XrayValidationReportHelp>

with specific help available everywhere you see the ⓘ symbol.

The types of validation reports are described at

<http://www.wwpdb.org/validation/2017/FAQs#types>.

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The following versions of software and data (see [references ⓘ](#)) were used in the production of this report:

MolProbity : 4.02b-467  
Mogul : 1.8.5 (274361), CSD as541be (2020)  
Xtriage (Phenix) : 1.13  
EDS : 2.36.2  
buster-report : 1.1.7 (2018)  
Percentile statistics : 20191225.v01 (using entries in the PDB archive December 25th 2019)  
Refmac : 5.8.0158  
CCP4 : 7.0.044 (Gargrove)  
Ideal geometry (proteins) : Engh & Huber (2001)  
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)  
Validation Pipeline (wwPDB-VP) : 2.36.2

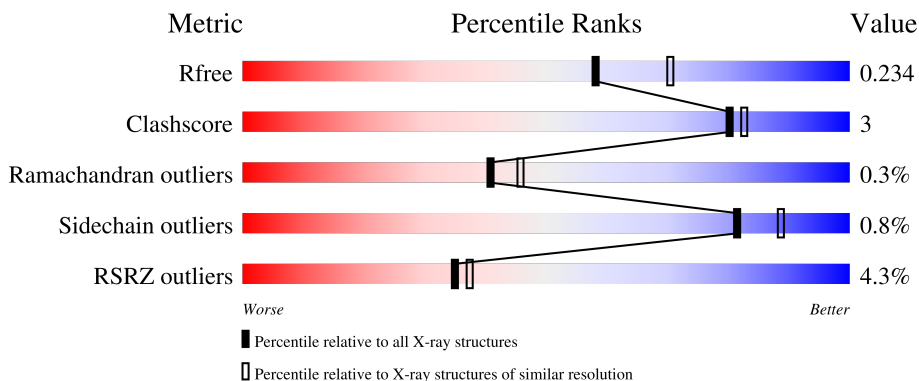
# 1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

*X-RAY DIFFRACTION*

The reported resolution of this entry is 2.25 Å.

Percentile scores (ranging between 0-100) for global validation metrics of the entry are shown in the following graphic. The table shows the number of entries on which the scores are based.



Metric	Whole archive (#Entries)	Similar resolution (#Entries, resolution range(Å))
$R_{free}$	130704	1377 (2.26-2.26)
Clashscore	141614	1487 (2.26-2.26)
Ramachandran outliers	138981	1449 (2.26-2.26)
Sidechain outliers	138945	1450 (2.26-2.26)
RSRZ outliers	127900	1356 (2.26-2.26)

The table below summarises the geometric issues observed across the polymeric chains and their fit to the electron density. The red, orange, yellow and green segments of the lower bar indicate the fraction of residues that contain outliers for  $\geq 3$ , 2, 1 and 0 types of geometric quality criteria respectively. A grey segment represents the fraction of residues that are not modelled. The numeric value for each fraction is indicated below the corresponding segment, with a dot representing fractions  $\leq 5\%$ . The upper red bar (where present) indicates the fraction of residues that have poor fit to the electron density. The numeric value is given above the bar.

Mol	Chain	Length	Quality of chain
1	A	551	
1	B	551	
1	C	551	
1	D	551	

## 2 Entry composition [i](#)

There are 7 unique types of molecules in this entry. The entry contains 15092 atoms, of which 0 are hydrogens and 0 are deuteriums.

In the tables below, the ZeroOcc column contains the number of atoms modelled with zero occupancy, the AltConf column contains the number of residues with at least one atom in alternate conformation and the Trace column contains the number of residues modelled with at most 2 atoms.

- Molecule 1 is a protein called Pyruvate kinase PKM.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	476	3452	2175	616	640	21	0	1	0
1	B	452	3308	2083	590	614	21	0	0	0
1	C	516	3737	2358	658	697	24	0	0	0
1	D	515	3841	2421	682	714	24	0	1	0

There are 80 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	-19	MET	-	initiating methionine	UNP P14618
A	-18	GLY	-	expression tag	UNP P14618
A	-17	SER	-	expression tag	UNP P14618
A	-16	SER	-	expression tag	UNP P14618
A	-15	HIS	-	expression tag	UNP P14618
A	-14	HIS	-	expression tag	UNP P14618
A	-13	HIS	-	expression tag	UNP P14618
A	-12	HIS	-	expression tag	UNP P14618
A	-11	HIS	-	expression tag	UNP P14618
A	-10	HIS	-	expression tag	UNP P14618
A	-9	SER	-	expression tag	UNP P14618
A	-8	SER	-	expression tag	UNP P14618
A	-7	GLY	-	expression tag	UNP P14618
A	-6	LEU	-	expression tag	UNP P14618
A	-5	VAL	-	expression tag	UNP P14618
A	-4	PRO	-	expression tag	UNP P14618
A	-3	ARG	-	expression tag	UNP P14618
A	-2	GLY	-	expression tag	UNP P14618
A	-1	SER	-	expression tag	UNP P14618
A	0	HIS	-	expression tag	UNP P14618
B	-19	MET	-	initiating methionine	UNP P14618

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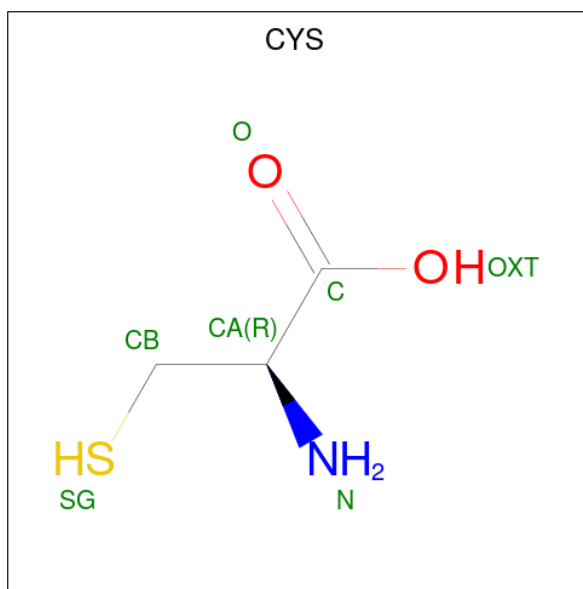
Chain	Residue	Modelled	Actual	Comment	Reference
B	-18	GLY	-	expression tag	UNP P14618
B	-17	SER	-	expression tag	UNP P14618
B	-16	SER	-	expression tag	UNP P14618
B	-15	HIS	-	expression tag	UNP P14618
B	-14	HIS	-	expression tag	UNP P14618
B	-13	HIS	-	expression tag	UNP P14618
B	-12	HIS	-	expression tag	UNP P14618
B	-11	HIS	-	expression tag	UNP P14618
B	-10	HIS	-	expression tag	UNP P14618
B	-9	SER	-	expression tag	UNP P14618
B	-8	SER	-	expression tag	UNP P14618
B	-7	GLY	-	expression tag	UNP P14618
B	-6	LEU	-	expression tag	UNP P14618
B	-5	VAL	-	expression tag	UNP P14618
B	-4	PRO	-	expression tag	UNP P14618
B	-3	ARG	-	expression tag	UNP P14618
B	-2	GLY	-	expression tag	UNP P14618
B	-1	SER	-	expression tag	UNP P14618
B	0	HIS	-	expression tag	UNP P14618
C	-19	MET	-	initiating methionine	UNP P14618
C	-18	GLY	-	expression tag	UNP P14618
C	-17	SER	-	expression tag	UNP P14618
C	-16	SER	-	expression tag	UNP P14618
C	-15	HIS	-	expression tag	UNP P14618
C	-14	HIS	-	expression tag	UNP P14618
C	-13	HIS	-	expression tag	UNP P14618
C	-12	HIS	-	expression tag	UNP P14618
C	-11	HIS	-	expression tag	UNP P14618
C	-10	HIS	-	expression tag	UNP P14618
C	-9	SER	-	expression tag	UNP P14618
C	-8	SER	-	expression tag	UNP P14618
C	-7	GLY	-	expression tag	UNP P14618
C	-6	LEU	-	expression tag	UNP P14618
C	-5	VAL	-	expression tag	UNP P14618
C	-4	PRO	-	expression tag	UNP P14618
C	-3	ARG	-	expression tag	UNP P14618
C	-2	GLY	-	expression tag	UNP P14618
C	-1	SER	-	expression tag	UNP P14618
C	0	HIS	-	expression tag	UNP P14618
D	-19	MET	-	initiating methionine	UNP P14618
D	-18	GLY	-	expression tag	UNP P14618
D	-17	SER	-	expression tag	UNP P14618

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Chain	Residue	Modelled	Actual	Comment	Reference
D	-16	SER	-	expression tag	UNP P14618
D	-15	HIS	-	expression tag	UNP P14618
D	-14	HIS	-	expression tag	UNP P14618
D	-13	HIS	-	expression tag	UNP P14618
D	-12	HIS	-	expression tag	UNP P14618
D	-11	HIS	-	expression tag	UNP P14618
D	-10	HIS	-	expression tag	UNP P14618
D	-9	SER	-	expression tag	UNP P14618
D	-8	SER	-	expression tag	UNP P14618
D	-7	GLY	-	expression tag	UNP P14618
D	-6	LEU	-	expression tag	UNP P14618
D	-5	VAL	-	expression tag	UNP P14618
D	-4	PRO	-	expression tag	UNP P14618
D	-3	ARG	-	expression tag	UNP P14618
D	-2	GLY	-	expression tag	UNP P14618
D	-1	SER	-	expression tag	UNP P14618
D	0	HIS	-	expression tag	UNP P14618

- Molecule 2 is CYSTEINE (three-letter code: CYS) (formula: C<sub>3</sub>H<sub>7</sub>NO<sub>2</sub>S).



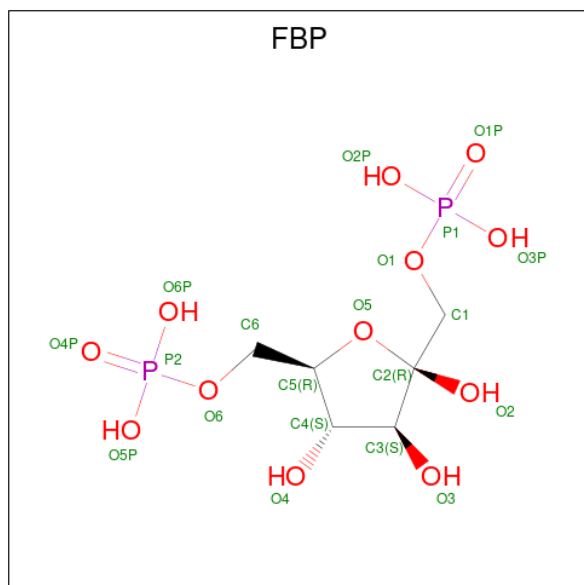
Mol	Chain	Residues	Atoms					ZeroOcc	AltConf
			Total	C	N	O	S		
2	A	1	Total	C	N	O	S	0	0
			7	3	1	2	1		
2	B	1	Total	C	N	O	S	0	0
			7	3	1	2	1		
2	C	1	Total	C	N	O	S	0	0
			7	3	1	2	1		

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Mol	Chain	Residues	Atoms					ZeroOcc	AltConf
			Total	C	N	O	S		
2	D	1	7	3	1	2	1	0	0

- Molecule 3 is 1,6-di-O-phosphono-beta-D-fructofuranose (three-letter code: FBP) (formula:  $C_6H_{14}O_{12}P_2$ ).

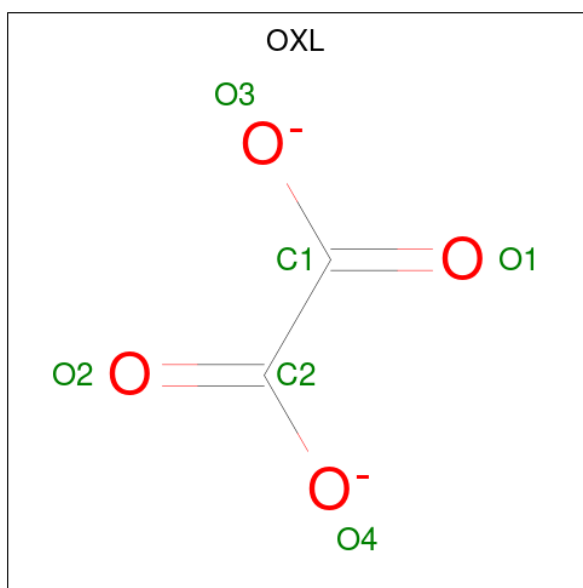


Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
			Total	C	O	P		
3	A	1	20	6	12	2	0	0
3	B	1	20	6	12	2	0	0
3	C	1	20	6	12	2	0	0
3	D	1	20	6	12	2	0	0

- Molecule 4 is MAGNESIUM ION (three-letter code: MG) (formula: Mg).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
			Total	Mg		
4	A	1	1	1	0	0
4	B	1	1	1	0	0
4	C	1	1	1	0	0
4	D	1	1	1	0	0

- Molecule 5 is OXALATE ION (three-letter code: OXL) (formula:  $C_2O_4$ ).



Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
5	A	1	Total C O 6 2 4	0	0
5	B	1	Total C O 6 2 4	0	0
5	C	1	Total C O 6 2 4	0	0
5	D	1	Total C O 6 2 4	0	0

- Molecule 6 is POTASSIUM ION (three-letter code: K) (formula: K).

Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
6	B	1	Total K 1 1	0	0
6	D	1	Total K 1 1	0	0

- Molecule 7 is water.

Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
7	A	149	Total O 149 149	0	0
7	B	146	Total O 146 146	0	0
7	C	108	Total O 108 108	0	0

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<b>Mol</b>	<b>Chain</b>	<b>Residues</b>	<b>Atoms</b>		<b>ZeroOcc</b>	<b>AltConf</b>
7	D	213	Total 213	O 213	0	0







## 4 Data and refinement statistics

Property	Value	Source
Space group	P 1 21 1	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	81.83Å 155.92Å 94.14Å 90.00° 103.51° 90.00°	Depositor
Resolution (Å)	24.70 – 2.25 24.70 – 2.25	Depositor EDS
% Data completeness (in resolution range)	97.8 (24.70-2.25) 97.8 (24.70-2.25)	Depositor EDS
$R_{merge}$	0.09	Depositor
$R_{sym}$	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ <sup>1</sup>	3.19 (at 2.26Å)	Xtrriage
Refinement program	PHENIX (1.15.2_3472: ???)	Depositor
R, $R_{free}$	0.191 , 0.235 0.191 , 0.234	Depositor DCC
$R_{free}$ test set	5287 reflections (4.99%)	wwPDB-VP
Wilson B-factor (Å <sup>2</sup> )	33.9	Xtrriage
Anisotropy	0.201	Xtrriage
Bulk solvent $k_{sol}$ (e/Å <sup>3</sup> ), $B_{sol}$ (Å <sup>2</sup> )	0.33 , 52.1	EDS
L-test for twinning <sup>2</sup>	$\langle  L  \rangle = 0.48$ , $\langle L^2 \rangle = 0.31$	Xtrriage
Estimated twinning fraction	No twinning to report.	Xtrriage
$F_o, F_c$ correlation	0.94	EDS
Total number of atoms	15092	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	39.0	wwPDB-VP

Xtrriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 3.74% of the height of the origin peak. No significant pseudotranslation is detected.*

<sup>1</sup>Intensities estimated from amplitudes.

<sup>2</sup>Theoretical values of  $\langle |L| \rangle$ ,  $\langle L^2 \rangle$  for acentric reflections are 0.5, 0.333 respectively for untwinned datasets, and 0.375, 0.2 for perfectly twinned datasets.

## 5 Model quality [i](#)

### 5.1 Standard geometry [i](#)

Bond lengths and bond angles in the following residue types are not validated in this section: FBP, OXL, MG, K

The Z score for a bond length (or angle) is the number of standard deviations the observed value is removed from the expected value. A bond length (or angle) with  $|Z| > 5$  is considered an outlier worth inspection. RMSZ is the root-mean-square of all Z scores of the bond lengths (or angles).

Mol	Chain	Bond lengths		Bond angles	
		RMSZ	# Z  >5	RMSZ	# Z  >5
1	A	0.27	0/3508	0.44	0/4755
1	B	0.27	0/3362	0.44	0/4559
1	C	0.26	0/3799	0.45	0/5164
1	D	0.28	0/3907	0.46	0/5296
All	All	0.27	0/14576	0.45	0/19774

There are no bond length outliers.

There are no bond angle outliers.

There are no chirality outliers.

There are no planarity outliers.

### 5.2 Too-close contacts [i](#)

In the following table, the Non-H and H(model) columns list the number of non-hydrogen atoms and hydrogen atoms in the chain respectively. The H(added) column lists the number of hydrogen atoms added and optimized by MolProbity. The Clashes column lists the number of clashes within the asymmetric unit, whereas Symm-Clashes lists symmetry-related clashes.

Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
1	A	3452	0	3311	22	0
1	B	3308	0	3198	17	0
1	C	3737	0	3599	20	0
1	D	3841	0	3817	20	0
2	A	7	0	4	1	0
2	B	7	0	4	0	0
2	C	7	0	4	1	0
2	D	7	0	4	0	0
3	A	20	0	10	4	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
3	B	20	0	10	1	0
3	C	20	0	10	1	0
3	D	20	0	10	1	0
4	A	1	0	0	0	0
4	B	1	0	0	0	0
4	C	1	0	0	0	0
4	D	1	0	0	0	0
5	A	6	0	0	1	0
5	B	6	0	0	0	0
5	C	6	0	0	0	0
5	D	6	0	0	0	0
6	B	1	0	0	0	0
6	D	1	0	0	0	0
7	A	149	0	0	1	0
7	B	146	0	0	0	0
7	C	108	0	0	2	0
7	D	213	0	0	1	0
All	All	15092	0	13981	78	0

The all-atom clashscore is defined as the number of clashes found per 1000 atoms (including hydrogen atoms). The all-atom clashscore for this structure is 3.

All (78) close contacts within the same asymmetric unit are listed below, sorted by their clash magnitude.

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:D:15:THR:HG22	1:D:16:GLN:HG3	1.70	0.74
1:A:482:TRP:HH2	3:A:602:FBP:H12	1.54	0.71
1:A:433:LYS:NZ	7:A:701:HOH:O	2.26	0.69
1:D:339:ARG:NH2	7:D:703:HOH:O	2.28	0.65
1:A:175:TYR:HB3	1:A:179:GLY:HA2	1.81	0.62
1:B:514:GLY:N	3:B:602:FBP:O3	2.37	0.58
1:C:175:TYR:HB3	1:C:179:GLY:HA2	1.86	0.56
1:A:482:TRP:CH2	3:A:602:FBP:H12	2.37	0.56
1:A:464:HIS:HD1	2:A:601:CYS:N	2.04	0.55
1:D:123:LEU:HB2	1:D:150:GLU:HA	1.90	0.53
1:C:48:ILE:HB	1:C:360:MET:HG3	1.91	0.53
1:A:270:LYS:HE2	1:A:272:GLU:OE2	2.09	0.52
1:A:497:GLY:HA3	1:A:503:PHE:CZ	2.44	0.52
1:C:142:ILE:HB	1:C:193:LEU:HB2	1.90	0.52
1:C:305:LYS:NZ	7:C:709:HOH:O	2.42	0.52
1:B:477:PRO:O	1:B:479:GLN:NE2	2.41	0.52

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:395:PHE:CZ	1:B:399:ARG:HD3	2.45	0.52
1:A:416:ALA:HB2	1:A:512:LEU:HD21	1.93	0.51
1:B:331:LEU:HD23	1:B:344:GLU:HB3	1.93	0.51
1:B:48:ILE:HG12	1:B:71:VAL:HB	1.93	0.50
1:B:472:VAL:HG11	1:B:496:VAL:HG11	1.92	0.50
1:D:339:ARG:NH2	1:D:339:ARG:HB3	2.27	0.49
1:A:117:PRO:HD2	1:A:244:PHE:HB2	1.93	0.49
1:A:432:THR:HA	3:A:602:FBP:H61	1.95	0.49
1:D:185:VAL:HA	1:D:195:THR:HG22	1.95	0.48
1:B:15:THR:HG22	1:B:38:PRO:HD2	1.95	0.48
1:B:246:ARG:HG2	1:B:273:ASN:HD21	1.79	0.48
1:C:464:HIS:HD1	2:C:601:CYS:N	2.12	0.48
1:B:497:GLY:HA3	1:B:503:PHE:CZ	2.49	0.48
1:B:323:PRO:HB3	1:B:465:LEU:O	2.14	0.47
1:C:409:THR:HG23	1:C:522:THR:HB	1.96	0.47
1:D:472:VAL:HG11	1:D:496:VAL:HG11	1.96	0.47
1:C:477:PRO:O	1:C:479:GLN:NE2	2.43	0.47
1:A:175:TYR:CE1	1:A:212:PRO:HG2	2.49	0.47
1:C:252:HIS:CE1	1:D:127:SER:HB2	2.49	0.47
1:D:517:PRO:HA	3:D:602:FBP:H12	1.97	0.46
1:B:64:MET:HE3	1:B:375:VAL:HG21	1.98	0.46
1:C:50:THR:OG1	1:C:73:ARG:NH1	2.43	0.46
1:A:433:LYS:HE3	1:A:455:ARG:HB2	1.97	0.46
1:C:431:LEU:HD22	1:C:453:VAL:HB	1.97	0.46
1:D:16:GLN:HG2	1:D:40:ILE:HG23	1.98	0.46
1:D:16:GLN:HB2	1:D:18:LEU:HG	1.98	0.46
1:A:433:LYS:HD3	1:A:433:LYS:HA	1.66	0.45
1:A:519:SER:HB2	3:A:602:FBP:O4P	2.16	0.45
1:D:339:ARG:HB3	1:D:339:ARG:HH21	1.81	0.45
1:A:477:PRO:O	1:A:479:GLN:NE2	2.44	0.45
1:C:157:LEU:HD12	1:C:203:LEU:HD21	1.98	0.44
1:A:472:VAL:HG11	1:A:496:VAL:HG21	2.00	0.44
1:A:293:ALA:HB1	5:A:604:OXL:C2	2.47	0.44
1:C:318:ASN:HD21	1:C:355:GLY:HA3	1.82	0.44
1:B:118:GLU:OE2	1:B:120:ARG:NH1	2.50	0.44
1:C:325:ILE:HG12	1:C:358:CYS:HB2	1.99	0.43
1:C:288:ASP:O	1:C:323:PRO:HD2	2.18	0.43
1:B:371:PRO:O	1:B:375:VAL:HG23	2.18	0.43
1:C:472:VAL:HG11	1:C:496:VAL:HG11	2.00	0.43
1:D:16:GLN:HB3	1:D:447[A]:ARG:NH1	2.34	0.43
1:C:432:THR:HA	3:C:602:FBP:H61	2.00	0.43

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:266:LYS:HA	1:A:266:LYS:HD3	1.87	0.42
1:C:416:ALA:HB1	1:C:510:ILE:HG21	2.01	0.42
1:D:409:THR:HG23	1:D:522:THR:HB	2.00	0.42
1:C:40:ILE:O	1:C:383:ARG:HD2	2.19	0.42
1:B:297:LEU:O	1:B:301:ILE:HG12	2.19	0.42
1:A:222:SER:O	1:A:226:ILE:HG13	2.19	0.42
1:D:124:ILE:HD13	1:D:152:CYS:HB2	2.02	0.42
1:D:142:ILE:HB	1:D:193:LEU:HB3	2.02	0.42
1:C:123:LEU:HB2	1:C:150:GLU:HA	2.01	0.42
1:B:239:MET:SD	1:B:465:LEU:HD21	2.60	0.42
1:D:328:THR:HG22	1:D:329:GLN:HG3	2.02	0.42
1:A:482:TRP:CE3	1:A:517:PRO:HG3	2.56	0.41
1:D:515:TRP:CD2	1:D:516:ARG:HG2	2.55	0.41
1:D:323:PRO:HB3	1:D:465:LEU:O	2.20	0.41
1:C:84:HIS:ND1	7:C:704:HOH:O	2.37	0.41
1:D:297:LEU:O	1:D:301:ILE:HG12	2.20	0.41
1:B:55:SER:HA	1:B:60:THR:HG21	2.02	0.41
1:B:70:ASN:HB3	1:B:464:HIS:CG	2.56	0.41
1:A:272:GLU:O	1:A:300:GLU:HG3	2.21	0.40
1:D:134:LEU:HD12	1:D:181:ILE:HD13	2.04	0.40
1:A:472:VAL:HG12	1:A:492:PHE:CE2	2.56	0.40

There are no symmetry-related clashes.

## 5.3 Torsion angles [\(i\)](#)

### 5.3.1 Protein backbone [\(i\)](#)

In the following table, the Percentiles column shows the percent Ramachandran outliers of the chain as a percentile score with respect to all X-ray entries followed by that with respect to entries of similar resolution.

The Analysed column shows the number of residues for which the backbone conformation was analysed, and the total number of residues.

Mol	Chain	Analysed	Favoured	Allowed	Outliers	Percentiles
1	A	463/551 (84%)	450 (97%)	11 (2%)	2 (0%)	34 37
1	B	442/551 (80%)	426 (96%)	14 (3%)	2 (0%)	29 29
1	C	512/551 (93%)	498 (97%)	13 (2%)	1 (0%)	47 55
1	D	512/551 (93%)	503 (98%)	8 (2%)	1 (0%)	47 55

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Mol	Chain	Analysed	Favoured	Allowed	Outliers	Percentiles
All	All	1929/2204 (88%)	1877 (97%)	46 (2%)	6 (0%)	41 46

All (6) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	163	ASN
1	B	328	THR
1	C	328	THR
1	D	328	THR
1	A	328	THR
1	B	173	LYS

### 5.3.2 Protein sidechains [i](#)

In the following table, the Percentiles column shows the percent sidechain outliers of the chain as a percentile score with respect to all X-ray entries followed by that with respect to entries of similar resolution.

The Analysed column shows the number of residues for which the sidechain conformation was analysed, and the total number of residues.

Mol	Chain	Analysed	Rotameric	Outliers	Percentiles
1	A	331/453 (73%)	329 (99%)	2 (1%)	86 91
1	B	320/453 (71%)	318 (99%)	2 (1%)	86 91
1	C	359/453 (79%)	355 (99%)	4 (1%)	73 82
1	D	393/453 (87%)	390 (99%)	3 (1%)	81 88
All	All	1403/1812 (77%)	1392 (99%)	11 (1%)	81 88

All (11) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	160	ASP
1	A	414	VAL
1	B	258	LEU
1	B	346	SER
1	C	197	VAL
1	C	272	GLU
1	C	443	ARG
1	C	458	GLN
1	D	100	SER

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Mol	Chain	Res	Type
1	D	272	GLU
1	D	443	ARG

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. There are no such sidechains identified.

### 5.3.3 RNA [i](#)

There are no RNA molecules in this entry.

### 5.4 Non-standard residues in protein, DNA, RNA chains [i](#)

There are no non-standard protein/DNA/RNA residues in this entry.

### 5.5 Carbohydrates [i](#)

There are no monosaccharides in this entry.

### 5.6 Ligand geometry [i](#)

Of 18 ligands modelled in this entry, 6 are monoatomic - leaving 12 for Mogul analysis.

In the following table, the Counts columns list the number of bonds (or angles) for which Mogul statistics could be retrieved, the number of bonds (or angles) that are observed in the model and the number of bonds (or angles) that are defined in the Chemical Component Dictionary. The Link column lists molecule types, if any, to which the group is linked. The Z score for a bond length (or angle) is the number of standard deviations the observed value is removed from the expected value. A bond length (or angle) with  $|Z| > 2$  is considered an outlier worth inspection. RMSZ is the root-mean-square of all Z scores of the bond lengths (or angles).

Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	# Z  > 2	Counts	RMSZ	# Z  > 2
3	FBP	D	602	-	18,20,20	0.93	1 (5%)	23,32,32	0.73	0
2	CYS	B	601	-	5,6,6	1.02	1 (20%)	5,7,7	1.67	2 (40%)
2	CYS	C	601	-	5,6,6	1.05	1 (20%)	5,7,7	1.41	1 (20%)
5	OXL	D	604	4	5,5,5	1.30	0	6,6,6	1.76	3 (50%)
3	FBP	C	602	-	18,20,20	0.91	1 (5%)	23,32,32	0.71	0
3	FBP	B	602	-	18,20,20	0.90	1 (5%)	23,32,32	0.81	0
3	FBP	A	602	-	18,20,20	0.95	1 (5%)	23,32,32	0.57	0

Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	# Z  > 2	Counts	RMSZ	# Z  > 2
5	OXL	B	604	4	5,5,5	1.30	0	6,6,6	1.50	2 (33%)
2	CYS	D	601	-	5,6,6	1.05	0	5,7,7	1.55	2 (40%)
5	OXL	C	604	4	5,5,5	1.32	0	6,6,6	1.51	2 (33%)
5	OXL	A	604	4	5,5,5	1.28	0	6,6,6	1.62	2 (33%)
2	CYS	A	601	-	5,6,6	1.01	1 (20%)	5,7,7	1.50	2 (40%)

In the following table, the Chirals column lists the number of chiral outliers, the number of chiral centers analysed, the number of these observed in the model and the number defined in the Chemical Component Dictionary. Similar counts are reported in the Torsion and Rings columns. '-' means no outliers of that kind were identified.

Mol	Type	Chain	Res	Link	Chirals	Torsions	Rings
3	FBP	D	602	-	-	5/13/32/32	0/1/1/1
2	CYS	B	601	-	-	0/6/6/6	-
2	CYS	C	601	-	-	0/6/6/6	-
5	OXL	D	604	4	-	0/4/4/4	-
3	FBP	C	602	-	-	2/13/32/32	0/1/1/1
3	FBP	B	602	-	-	3/13/32/32	0/1/1/1
3	FBP	A	602	-	-	2/13/32/32	0/1/1/1
5	OXL	B	604	4	-	0/4/4/4	-
2	CYS	D	601	-	-	0/6/6/6	-
5	OXL	C	604	4	-	0/4/4/4	-
5	OXL	A	604	4	-	0/4/4/4	-
2	CYS	A	601	-	-	0/6/6/6	-

All (7) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
3	D	602	FBP	O2-C2	2.96	1.45	1.40
3	A	602	FBP	O2-C2	2.86	1.45	1.40
3	C	602	FBP	O2-C2	2.83	1.45	1.40
3	B	602	FBP	O2-C2	2.62	1.45	1.40
2	C	601	CYS	OXT-C	-2.17	1.23	1.30
2	A	601	CYS	OXT-C	-2.05	1.23	1.30
2	B	601	CYS	OXT-C	-2.01	1.24	1.30

All (16) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	B	601	CYS	OXT-C-O	-2.85	117.62	124.09

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	D	601	CYS	OXT-C-O	-2.58	118.24	124.09
2	A	601	CYS	OXT-C-O	-2.50	118.42	124.09
2	C	601	CYS	OXT-C-O	-2.44	118.54	124.09
5	D	604	OXL	O3-C1-C2	2.40	120.30	113.16
5	C	604	OXL	O3-C1-C2	2.34	120.12	113.16
5	A	604	OXL	O3-C1-C2	2.31	120.03	113.16
2	B	601	CYS	OXT-C-CA	2.26	121.08	113.38
5	D	604	OXL	O4-C2-C1	2.25	119.84	113.16
2	D	601	CYS	OXT-C-CA	2.16	120.73	113.38
2	A	601	CYS	OXT-C-CA	2.15	120.70	113.38
5	B	604	OXL	O4-C2-C1	2.12	119.45	113.16
5	A	604	OXL	O4-C2-C1	2.09	119.37	113.16
5	C	604	OXL	O4-C2-C1	2.09	119.37	113.16
5	D	604	OXL	O3-C1-O1	-2.08	118.85	123.61
5	B	604	OXL	O3-C1-C2	2.06	119.27	113.16

There are no chirality outliers.

All (12) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
3	A	602	FBP	C4-C5-C6-O6
3	B	602	FBP	O1-C1-C2-C3
3	B	602	FBP	O1-C1-C2-O5
3	C	602	FBP	C4-C5-C6-O6
3	D	602	FBP	O1-C1-C2-O2
3	D	602	FBP	O1-C1-C2-C3
3	D	602	FBP	O1-C1-C2-O5
3	D	602	FBP	C4-C5-C6-O6
3	A	602	FBP	O5-C5-C6-O6
3	C	602	FBP	O5-C5-C6-O6
3	D	602	FBP	O5-C5-C6-O6
3	B	602	FBP	O1-C1-C2-O2

There are no ring outliers.

7 monomers are involved in 10 short contacts:

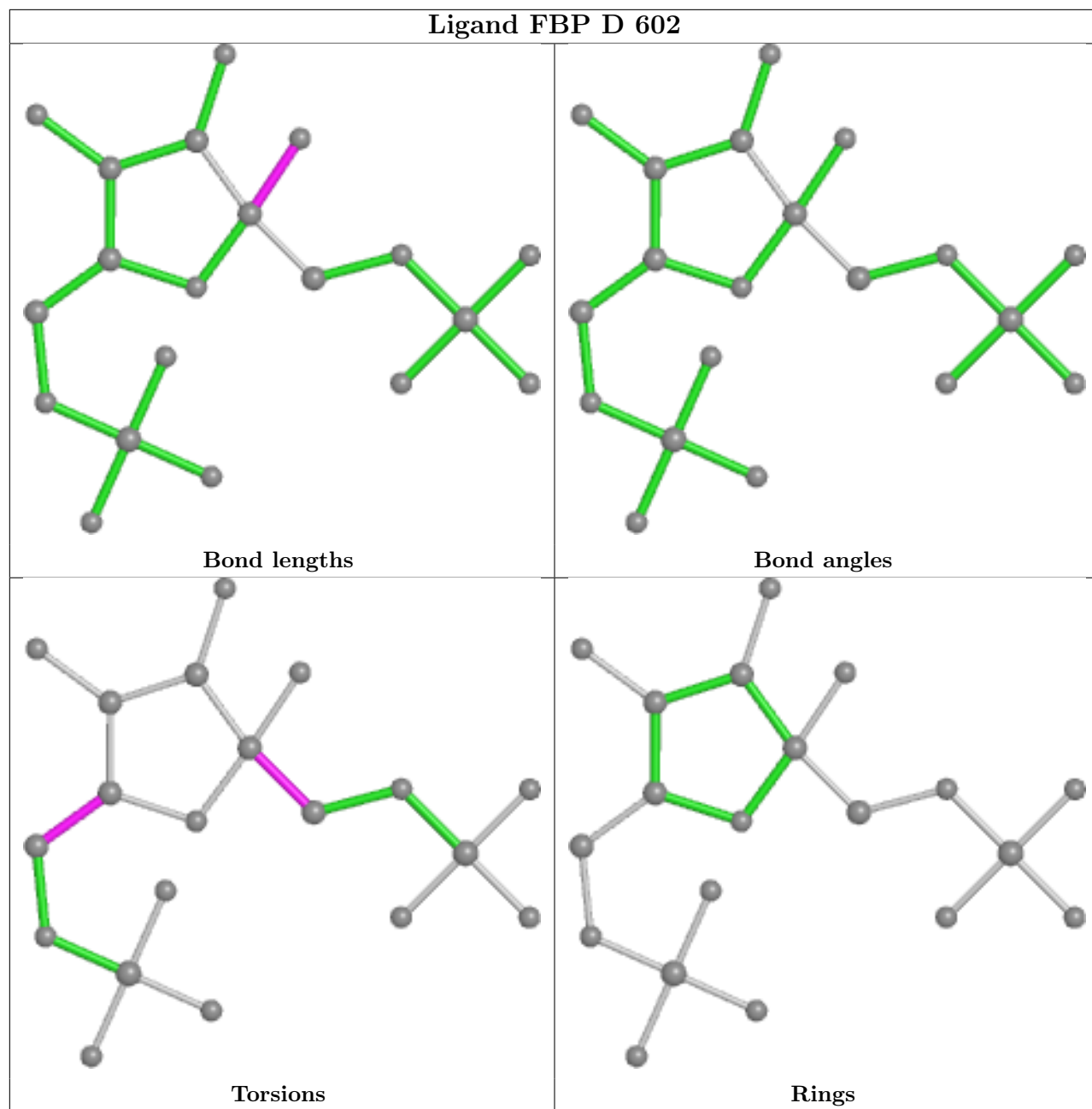
Mol	Chain	Res	Type	Clashes	Symm-Clashes
3	D	602	FBP	1	0
2	C	601	CYS	1	0
3	C	602	FBP	1	0
3	B	602	FBP	1	0

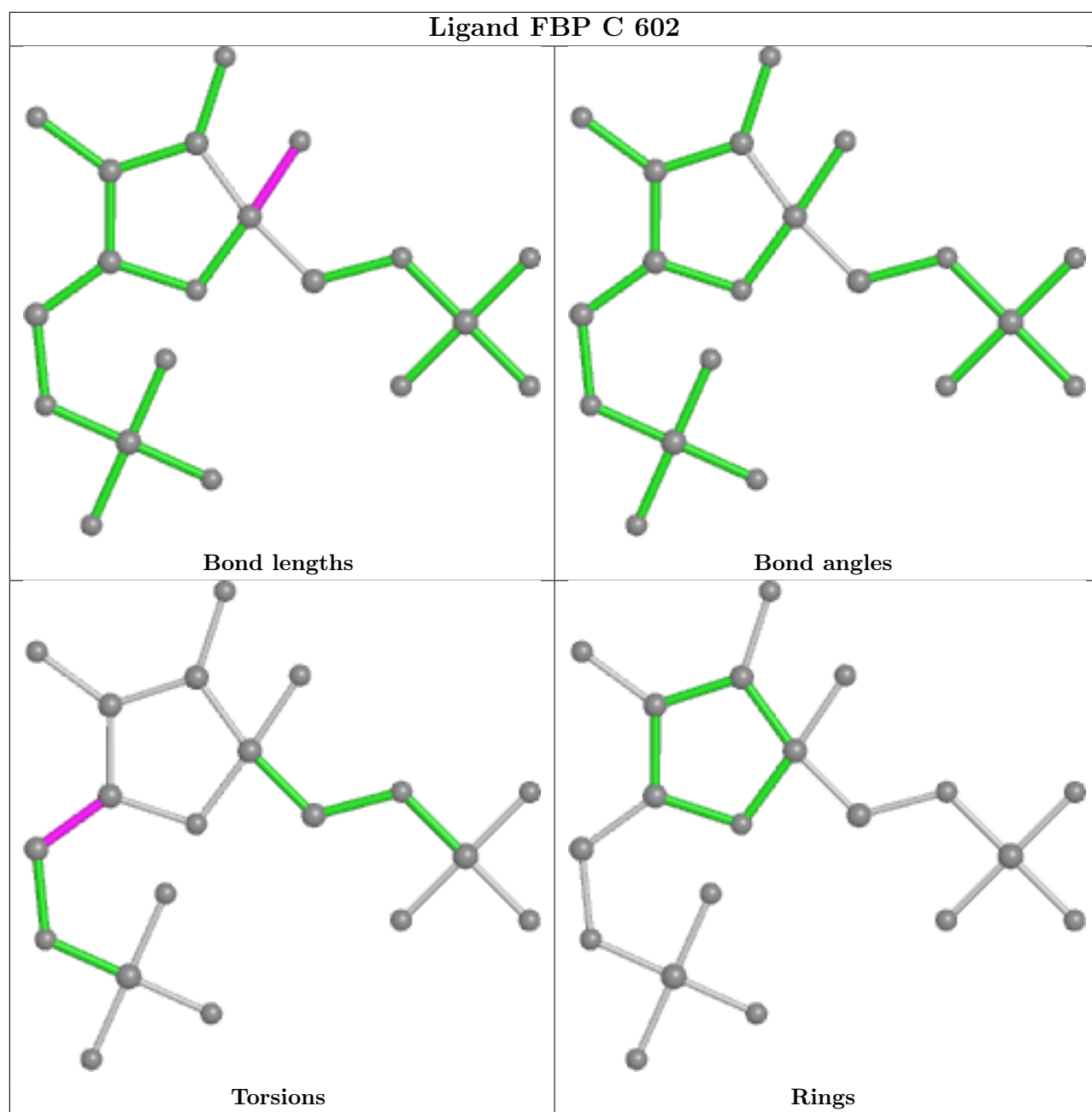
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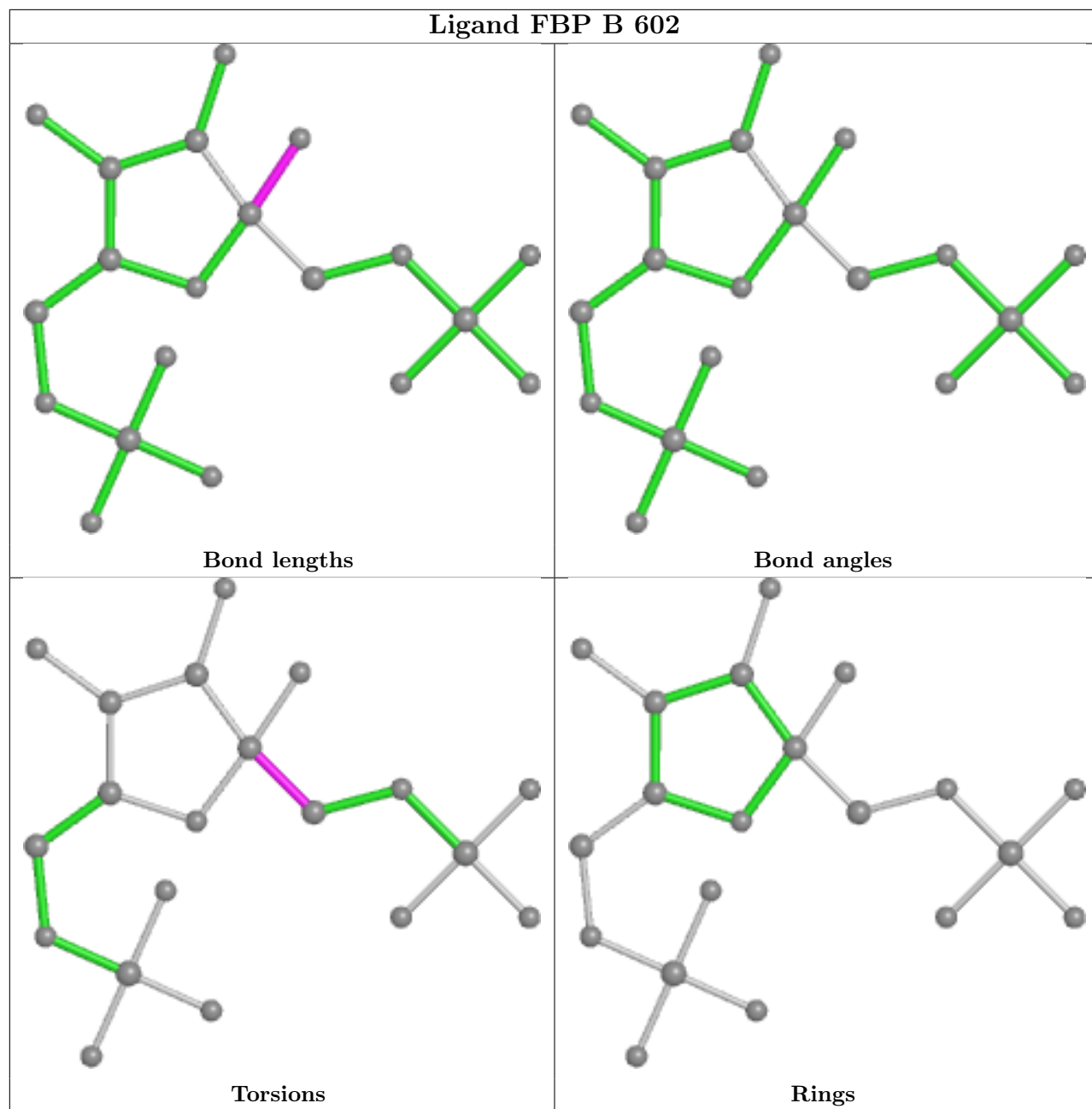
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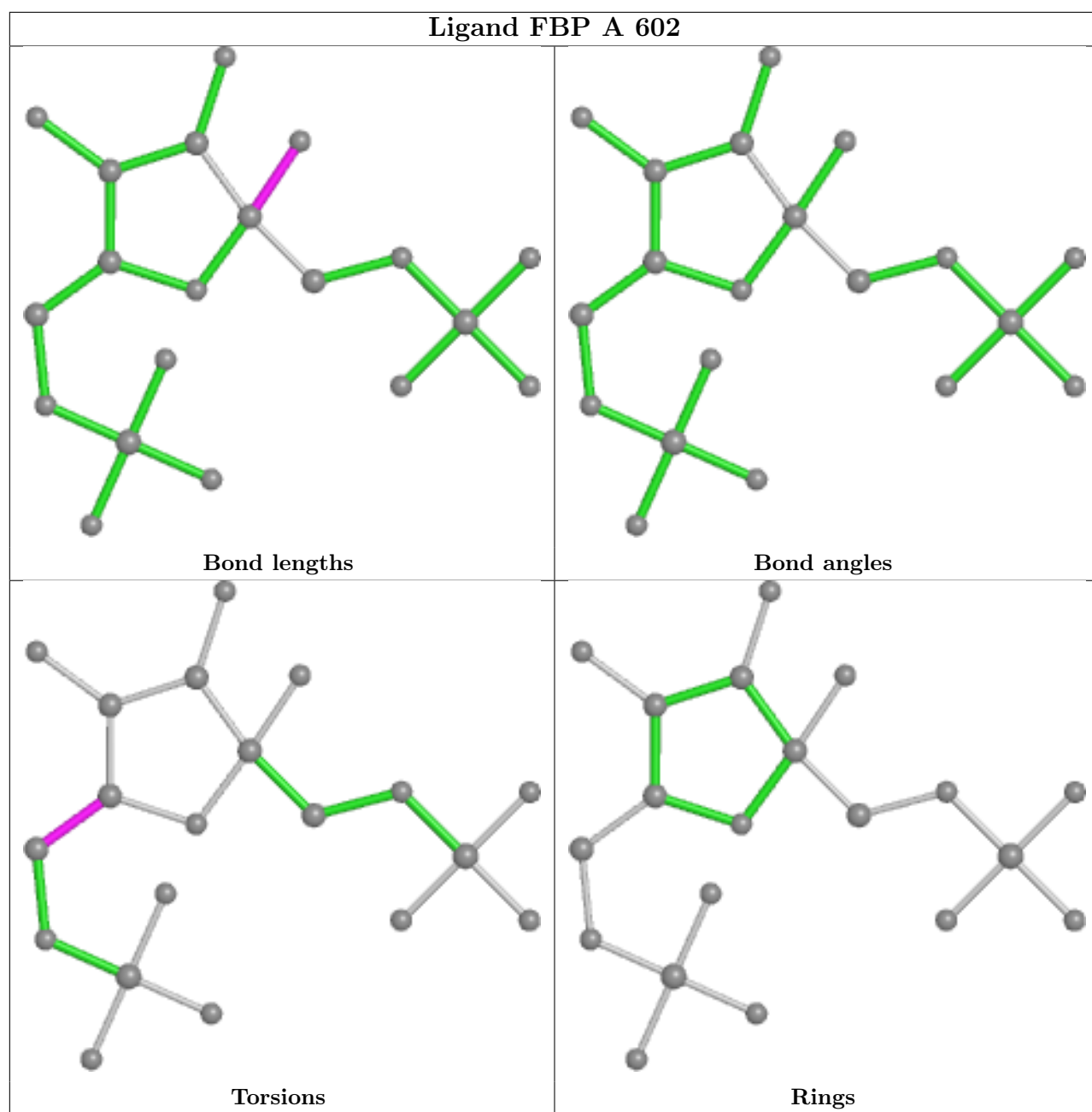
Mol	Chain	Res	Type	Clashes	Symm-Clashes
3	A	602	FBP	4	0
5	A	604	OXL	1	0
2	A	601	CYS	1	0

The following is a two-dimensional graphical depiction of Mogul quality analysis of bond lengths, bond angles, torsion angles, and ring geometry for all instances of the Ligand of Interest. In addition, ligands with molecular weight > 250 and outliers as shown on the validation Tables will also be included. For torsion angles, if less than 5% of the Mogul distribution of torsion angles is within 10 degrees of the torsion angle in question, then that torsion angle is considered an outlier. Any bond that is central to one or more torsion angles identified as an outlier by Mogul will be highlighted in the graph. For rings, the root-mean-square deviation (RMSD) between the ring in question and similar rings identified by Mogul is calculated over all ring torsion angles. If the average RMSD is greater than 60 degrees and the minimal RMSD between the ring in question and any Mogul-identified rings is also greater than 60 degrees, then that ring is considered an outlier. The outliers are highlighted in purple. The color gray indicates Mogul did not find sufficient equivalents in the CSD to analyse the geometry.









## 5.7 Other polymers [i](#)

There are no such residues in this entry.

## 5.8 Polymer linkage issues [i](#)

There are no chain breaks in this entry.



## 6 Fit of model and data

### 6.1 Protein, DNA and RNA chains

In the following table, the column labelled ‘#RSRZ > 2’ contains the number (and percentage) of RSRZ outliers, followed by percent RSRZ outliers for the chain as percentile scores relative to all X-ray entries and entries of similar resolution. The OWAB column contains the minimum, median, 95<sup>th</sup> percentile and maximum values of the occupancy-weighted average B-factor per residue. The column labelled ‘Q < 0.9’ lists the number of (and percentage) of residues with an average occupancy less than 0.9.

Mol	Chain	Analysed	<RSRZ>	#RSRZ>2	OWAB(Å <sup>2</sup> )	Q<0.9
1	A	476/551 (86%)	0.05	24 (5%) 28 31	19, 37, 78, 90	0
1	B	452/551 (82%)	-0.02	21 (4%) 32 35	23, 37, 68, 97	0
1	C	516/551 (93%)	0.02	22 (4%) 35 37	27, 43, 65, 82	0
1	D	515/551 (93%)	-0.07	17 (3%) 46 48	18, 32, 60, 75	0
All	All	1959/2204 (88%)	-0.00	84 (4%) 35 37	18, 38, 66, 97	0

All (84) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	217	ASP	6.1
1	B	121	THR	5.8
1	C	15	THR	5.7
1	A	134	LEU	4.8
1	B	161	TYR	4.2
1	A	15	THR	4.2
1	A	214	ALA	4.2
1	B	180	LEU	4.1
1	A	215	ALA	4.1
1	A	157	LEU	4.1
1	A	153	ASP	4.0
1	C	100	SER	3.9
1	B	215	ALA	3.7
1	A	14	GLN	3.7
1	C	213	GLY	3.7
1	C	18	LEU	3.6
1	D	130	ALA	3.5
1	D	531	PRO	3.5
1	B	172	SER	3.5
1	D	14	GLN	3.5
1	C	190	ALA	3.4

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<b>Mol</b>	<b>Chain</b>	<b>Res</b>	<b>Type</b>	<b>RSRZ</b>
1	D	481	ALA	3.4
1	C	404	ILE	3.2
1	B	217	ASP	3.1
1	D	403	PRO	3.1
1	A	18	LEU	3.1
1	C	21	ALA	3.1
1	D	15	THR	3.0
1	D	215	ALA	3.0
1	C	215	ALA	3.0
1	B	531	PRO	3.0
1	B	201	GLY	3.0
1	A	531	PRO	2.9
1	B	216	VAL	2.9
1	C	518	GLY	2.8
1	B	120	ARG	2.8
1	A	200	GLY	2.8
1	B	198	GLU	2.8
1	D	138	ALA	2.7
1	A	216	VAL	2.7
1	D	18	LEU	2.7
1	B	199	ASN	2.7
1	A	152	CYS	2.6
1	B	15	THR	2.6
1	C	170	VAL	2.6
1	C	16	GLN	2.6
1	C	148	TYR	2.5
1	C	22	MET	2.5
1	B	515	TRP	2.5
1	C	19	HIS	2.5
1	C	478	VAL	2.4
1	B	452	ALA	2.4
1	D	16	GLN	2.4
1	B	173	LYS	2.4
1	A	144	LEU	2.4
1	C	403	PRO	2.4
1	C	99	ALA	2.4
1	C	406	SER	2.3
1	A	204	GLY	2.3
1	A	41	THR	2.3
1	B	451	ILE	2.3
1	A	111	ALA	2.2
1	A	112	LEU	2.2

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Mol	Chain	Res	Type	RSRZ
1	D	126	GLY	2.2
1	C	429	ILE	2.2
1	C	38	PRO	2.2
1	D	217	ASP	2.2
1	D	516	ARG	2.2
1	D	404	ILE	2.2
1	B	519	SER	2.2
1	A	155	ASN	2.1
1	B	171	GLY	2.2
1	C	20	ALA	2.1
1	A	218	LEU	2.1
1	A	78	HIS	2.1
1	D	169	GLU	2.1
1	C	72	ALA	2.1
1	A	202	SER	2.1
1	A	240	VAL	2.1
1	B	23	ALA	2.1
1	D	129	THR	2.1
1	A	40	ILE	2.1
1	B	19	HIS	2.0
1	D	20	ALA	2.0

## 6.2 Non-standard residues in protein, DNA, RNA chains [i](#)

There are no non-standard protein/DNA/RNA residues in this entry.

## 6.3 Carbohydrates [i](#)

There are no monosaccharides in this entry.

## 6.4 Ligands [i](#)

In the following table, the Atoms column lists the number of modelled atoms in the group and the number defined in the chemical component dictionary. The B-factors column lists the minimum, median, 95<sup>th</sup> percentile and maximum values of B factors of atoms in the group. The column labelled 'Q< 0.9' lists the number of atoms with occupancy less than 0.9.

Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(Å <sup>2</sup> )	Q<0.9
6	K	B	605	1/1	0.83	0.16	86,86,86,86	0
3	FBP	B	602	20/20	0.92	0.17	37,67,81,82	0

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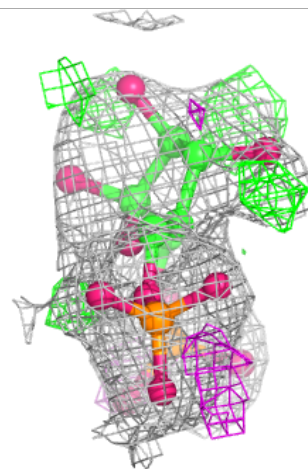
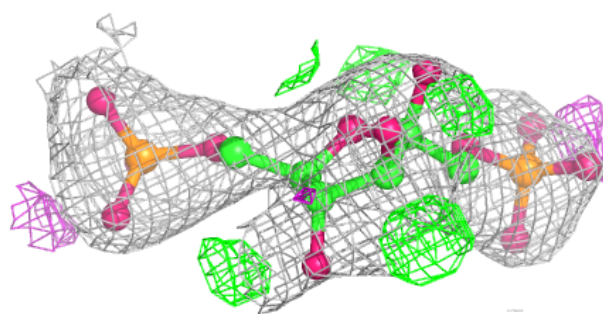
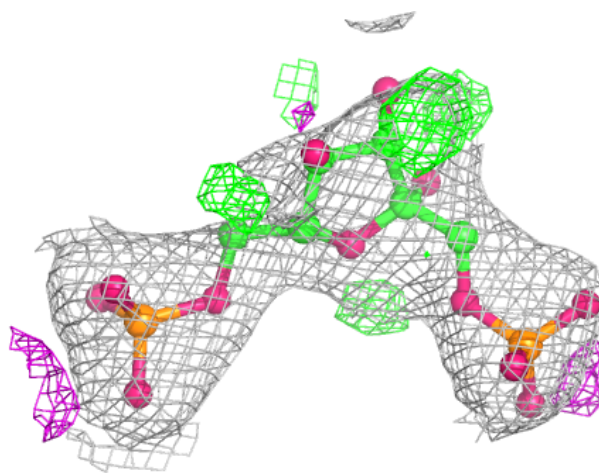
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Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors( $\text{\AA}^2$ )	Q<0.9
5	OXL	C	604	6/6	0.93	0.23	39,43,45,47	0
5	OXL	A	604	6/6	0.94	0.12	32,36,44,48	0
6	K	D	605	1/1	0.94	0.07	51,51,51,51	0
3	FBP	C	602	20/20	0.95	0.11	41,47,69,70	20
5	OXL	B	604	6/6	0.96	0.09	36,41,48,53	0
3	FBP	A	602	20/20	0.96	0.14	30,42,55,60	0
5	OXL	D	604	6/6	0.96	0.12	28,30,37,39	0
3	FBP	D	602	20/20	0.96	0.12	29,43,58,63	0
2	CYS	C	601	7/7	0.96	0.09	39,41,47,47	0
4	MG	A	603	1/1	0.97	0.05	36,36,36,36	0
4	MG	B	603	1/1	0.97	0.04	41,41,41,41	0
4	MG	D	603	1/1	0.97	0.04	31,31,31,31	0
2	CYS	A	601	7/7	0.98	0.07	29,33,36,38	0
4	MG	C	603	1/1	0.98	0.04	41,41,41,41	0
2	CYS	B	601	7/7	0.98	0.11	25,25,29,30	7
2	CYS	D	601	7/7	0.99	0.06	27,29,31,33	0

The following is a graphical depiction of the model fit to experimental electron density of all instances of the Ligand of Interest. In addition, ligands with molecular weight > 250 and outliers as shown on the geometry validation Tables will also be included. Each fit is shown from different orientation to approximate a three-dimensional view.

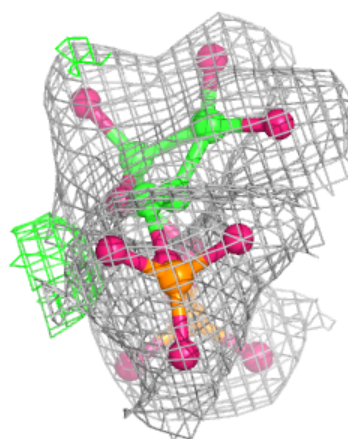
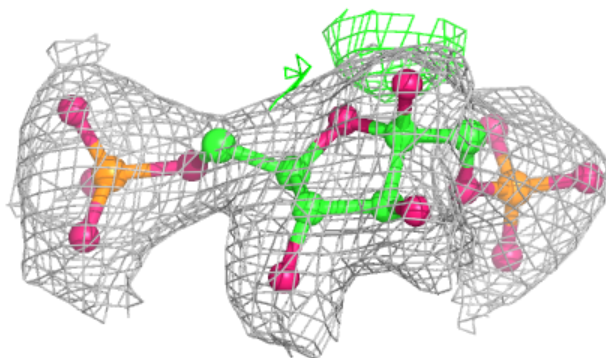
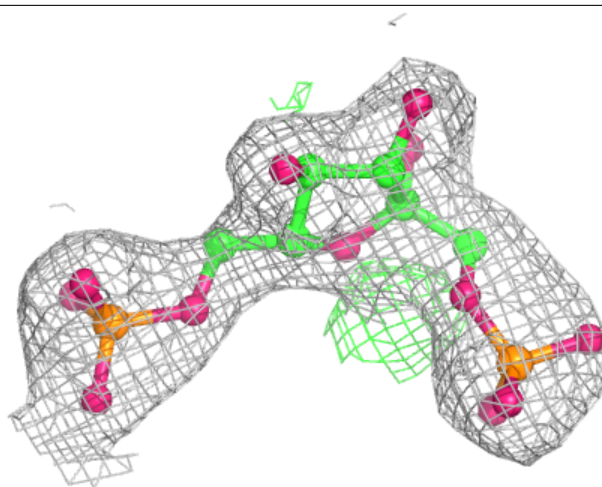
**Electron density around FBP B 602:**

$2mF_o-DF_c$  (at 0.7 rmsd) in gray  
 $mF_o-DF_c$  (at 3 rmsd) in purple (negative)  
and green (positive)



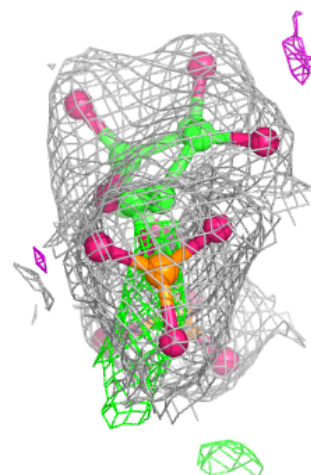
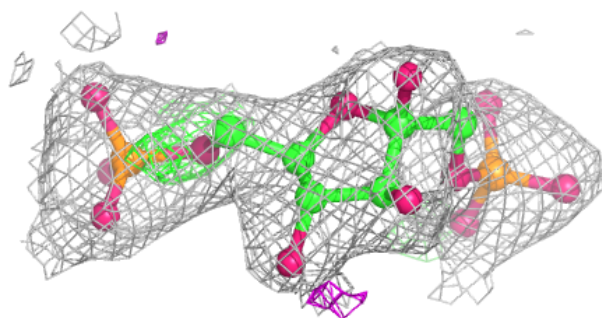
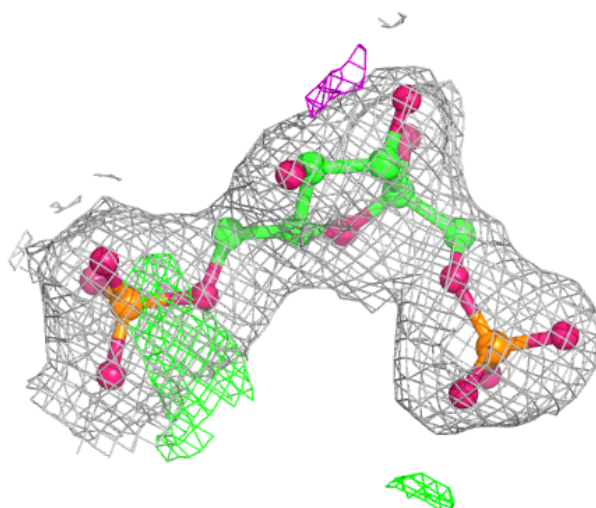
**Electron density around FBP C 602:**

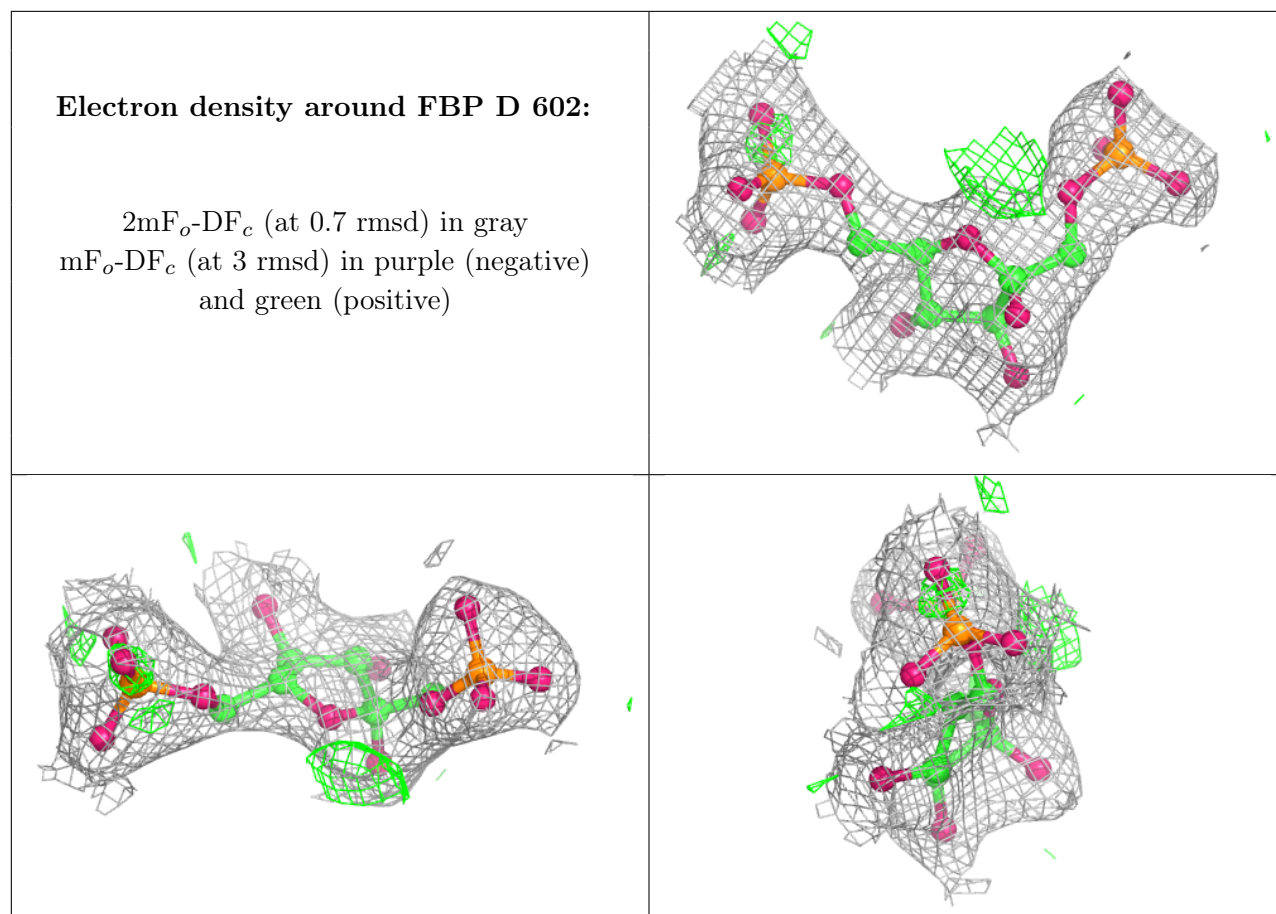
$2mF_o-DF_c$  (at 0.7 rmsd) in gray  
 $mF_o-DF_c$  (at 3 rmsd) in purple (negative)  
and green (positive)



**Electron density around FBP A 602:**

$2mF_o-DF_c$  (at 0.7 rmsd) in gray  
 $mF_o-DF_c$  (at 3 rmsd) in purple (negative)  
and green (positive)





## 6.5 Other polymers [i](#)

There are no such residues in this entry.